

## THE FRESH-WATER MUSSELS OF AUSTRALIA.

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(Plates iii.-vi.)

Recent acquisitions at the Australian Museum necessitated the determination of some of these interesting shells, and so much confusion was found that a review was undertaken. To furnish a complete monograph would take many years, so a short resumé of our present knowledge is here offered to promote study. Elsewhere these shells are favourites, but nothing has been done in connection with them in this country for half a century. Hitherto river systems and geography have been neglected, and these items are most important.

In the Proceedings of the Linnean Society of London, Zoology, Vol. xvi., 1881, the conchologist of the British Museum, E. A. Smith, furnished a report "On the Freshwater Shells of Australia." On pages 307-313 an excellent account, from an extra-limital museum worker's point of view, was presented, and so well was it prepared that it has been accepted without criticism for over fifty years.

In that list all the species were listed, save one, under the genus *Unio*, and eighteen species were admitted, while eleven other names were ranked as synonyms. All the species had been figured, so no illustrations accompanied Smith's report.

Simpson, in his Catalogue of the Naiades, pt. iii., 1914, admitted *Diplodon (Hyridella) dorsuosus* Gould, 1850 = *nepeanensis* Conrad, 1852, *glenelgensis* Dennant, *vittatus* Lea, *lessoni* Kuster, *australis* auct. with many synonyms, and var. *legrandi* Petterd, *jeffreysianus* Lea, *profugus* Gould, *moretonicus* Reeve, *cultelliformis* Conrad = ? *depressa* Lam. = *paramattensis* Lea, *wilsonii* Lea = *stuarti* A. Adams & Angas, *evansi* A. Adams & Angas, (*Cucumaria*) *novae hollandiae* Gray = *cucumoides* Lea = *cumingianus* Dunker, *shuttleworthii* Lea = ? *mutabilis* Reeve = *angasi* Sowerby, and *mutabilis* Lea.

A synöpsis of the Naiades had been previously published by Simpson (Proc. U.S. Nat. Mus., xxiii., 501-1044, October 8, 1900), but as the catalogue shows his later conclusions, and as in both cases he was not well conversant with Australasian forms, only the completed catalogue is here quoted.

Simpson's classification is of one family, Unionidae, split into sub-families, of which the subfamily Hyriinae is diagnosed as having "Beak sculpture radial." This is subdivided into groups: *Rosanorhamphus*, with the "Beak sculpture generally zigzag radial; epidermis often bright," and *Lamphorhamphus*, with the "Beak sculpture radial, often curved; shell dull colored." Under the latter, Simpson classed all our mussels in the one genus, *Diplodon*, placing most under the subgenus, *Hyridella*, described as having (p. 1288) "Beaks rather low, sculpture consisting of curved, generally nodulous ridges."

Swainson had indicated that in some Australian shells the beaks were not "sulcated," but this striking feature was overlooked until Frierson again recorded the fact. Immature specimens, brought in to me by Mr. H. J. Overall from the Railway Tank at Clearfield, near Grafton, N.S.W., showed no beak sculpture, and this re-discovery led me to investigate this family. Probably this lack of beak sculpture in Australian mussels may not claim such a high value as is given elsewhere, but in connection with the absence of a hooked glochidium stage suggests the usage of a family, *Propehyri-*

*dellidae*, for all the Australian freshwater mussels. It may be noted that Ihering (Nautilus, xv., September, 1901, 52) advocated the distinction of the South American mussels with family rank, under the name, *Diplodontidae*; our family is nearest to this one.

By means of shell characters alone, Australian mussels are divisible into groups, and these are confirmed by study of the hinge features, while the scars of the muscles are also characteristic. It will be seen that there has been great confusion in their nomination through lack of information of the above features, and the data here produced will, it is hoped, incite interest and investigation. Many more forms and species probably exist than are here noted, while longer series will also enable separation of forms of the species here allowed.

Again, all our mussels are placed in the one family, though some have smooth umbones, and some have plicate beaks. Later study of the animals will enable separation and perhaps correlation with extra-limital genera, but in the meanwhile it would be very unwise to attach any species to extra-limital genera without complete examination of animals comparatively. However, in order that mistakes may be minimised, the species with plicate beaks will be classed together, in two subfamilies, *Propehyridellinae* and *Cucumerunionae*. Thus Family *Propehyridellidae*.

Subfamily *Velesunionae*. Beaks smooth.

Subfamily *Lortzellinae*. Beaks ridged.

Subfamily *Cucumerunionae*. Beaks plicate. Shell large.

Subfamily *Propehyridellinae*. Beaks plicate. Shell small.

There has been so much misusage of names in the past that no records of animal characters can be assigned at present, and no further investigation in this direction can be undertaken until the shell names have been correctly allotted. Further, the river systems, so much utilised elsewhere in the discrimination of species, are not yet well known, as very similar species are found in apparently distinct systems. The species have been distinguished, taking geographical data into consideration, with the material at hand, and this review must be understood as a basic attempt only. Many of the older species were described from "Australia," and careful criticism of series with the figures has resulted in the assignment of the names as hereafter given. Many figures are known, but they are scattered throughout many books, none of them commonly available to the student to-day, so photographs are here offered of the species recognised.

This essay is offered as an introduction only, and it is hoped that search will be made in many rivers, as many inquiries are received regarding the possibility of their commercial value as pearl shell. Specimens may be sent to the Australian Museum for identification.

*Note.*—After this paper had been prepared I received a very unexpected account of the "Australian Unionidae," by B. C. Cotton and C. J. Gabriel (Proc. Roy. Soc. Vict., vol. 44 (n.s.), pp. 155-160, pl. xvi., published April 20, 1932). Covering exactly the same ground as my essay, these writers did not have access to the literature available to me, and their collections were of much less extent, save as regards South Australia and Victoria. They have introduced two new generic names, *Propehyridella* (p. 158), with type, *U. nepeanensis* Conrad, arranging thereunder *cultelliformis* Conrad (= *depressus* Lamarck), *narracanensis* nov. (Narracan River, Gippsland, Victoria), and *nepeanensis* Conrad (p. 159) and *Protohyridella* (p. 159), with type, *U. glenelgensis* Dennant. In my MS. I had proposed a new generic name for the *depressa* group, but had regarded *glenelgensis* as worthy only



of subgeneric rank. Otherwise there is little conflict with my conclusions in their paper, and I am simply making the necessary alterations with a few comments when needful.

A large quantity of useful material accompanied by exact notes has been forwarded to the Museum by Mr. H. Bernhard, of Rockhampton, Queensland, and this has confirmed my previous conclusions as to the stability and variability of the species and genera.

#### Genus VELESUNIO nov.

##### Type *Unio balonnensis* Conrad.

This name is introduced for large series of Australian mussels which have been variously named.

The characteristics of the group as regards shell features are well marked and easily recognisable.

Shell thin, with beaks submedian, smooth, neither radial nor zigzag nodulation being present; swollen but little winged, growth stages being sometimes well marked, but otherwise the only sculpture is delicate, concentric striation. Teeth normal, two pseudocardinals and one lateral in right valve, one pseudocardinal and two laterals in left valve; the teeth elongate and slender. Muscle scars lightly impressed, the anterior adductor large, the anterior retractor-pedis small and fused with the adductor, the protractor-pedis rounded, medium and not separated from the adductor, though line of demarcation usually present; posterior scars so lightly marked that they cannot be utilised easily; dorsal scars four in a line under the beaks sometimes coalescing. Nacre of varied coloration.

Previous descriptions of animals may apply to this genus, but re-investigation is necessary in connection with the species as distinguished in this account.

#### VELESUNIO BALONNENSIS.

(Plate iii., figs. 1-3; pl. iv., figs. 1-3.)

1850. *balonnensis*, *Unio*, Conrad, Proc. Acad. Nat. Sci. Philad., v. (1), 10, February. Balonne River, New South Wales.  
 1854. *balonnensis*, *Unio*, Conrad, Journ. Acad. Nat. Sci. Philad., iii., 295, pl. xxvi., fig. 3, February.  
 1881. *ambiguus*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool. xvi., 309.  
 1914. *australis*, *Unio*, Simpson, Cat. Naiades, iii., 1297.

For East Australian shells of this genus the specific name *ambiguus* has been commonly used, but Philippi's figure agrees better with West Australian shells, and is there allotted. Lamarck's *australis* and *depressa* have both been utilised, but are undoubtedly inapplicable, and *balonnensis* is the earliest name for a New South Wales shell. Long series showing growth and individual variation are at hand from the Moonie River, a tributary of the Barwon River, which is part of the Balonne River system. These have been compared with specimens from the Balonne River and agree minutely. Shells of medium size, oval, little winged, beaks a little anterior, much swollen posteriorly, thin, concentric growth ridges marked, posterior ridge elevated, rounded.

Specimens from the Richmond River are much more compressed, apparently larger, but differ, notably in shape, anteriorly, showing somewhat acute angulation, the dorsal ridge flattened, the posterior slope shallow, the ventral margin well rounded. For the present these are separated subspecifically only as *V. balonnensis adjunctus* subsp. nov.

From around about Rockhampton, Port Curtis, Queensland, many specimens very like the typical *balonnensis* are at hand. They are proportionally a little deeper and during growth stages more swollen, though the very aged most swollen Balonne shells may equal them. The concentric growth ridges are more pronounced, and these are named sub-specifically *V. balonnensis intricatus* subsp. nov.

It must be recorded that the study of these shells must take into consideration the vicissitudes of the inland rivers under drought conditions, and, hence, distortion in growth in many specimens from such localities.

Cotton and Gabriel have admitted two species, *H. australis* (Lam) and *H. ambigua* (Philippi) from Queensland, New South Wales, Victoria, Tasmania, South Australia and West Australia, recording the former only from Victoria and Tasmania, and the latter from South Australia and West Australia alongside, a confusion not in accordance with geographical distribution as I have used it. A specimen from the National Museum, Melbourne, labelled *Hyridella australis*, from the Darling River, N.S.W., Coll. F. Cudmore, 1929, is elongate, like *danellii*, from the Dandenong; typical *danellii* are labelled *australis*.

#### VELESUNIO DANELLII.

(Plate iii., fig. 4; pl. iv., fig. 4.)

1871. *danellii*, *Unio*, Villa, Journ. de Conch., xix. (3 ser. xi.), 328, October 1, "in Australia meridionale, in rivulo prope Brunswick," i.e., tributary of the River Yarra, Victoria.
1871. *jeffreysianus*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., n.s., 188, October 24. Australia = River Yarra, Victoria.
1874. *jeffreysianus*, *Unio*, Lea, Proc. Journ. Acad. Nat. Sci. Philad., viii., 23, pl. vii., fig. 20, April.
1881. *danellii*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 311.
1914. *jeffreysianus*, *Diplodon*, Simpson, Cat. Naiades, iii., 1299.

The common Yarra shell was undoubtedly named *danellii*, as the measurements testify, 92 x 57 x 34 mm., and Crosse, the editor of the French journal, noted at the time he was the possessor of specimens of the same species from the river Yarra, sent to him by Dr. J. Cox, unaware of the exact location of Brunswick, in Southern Australia.

The measurements of *jeffreysianus*, 2.8 x 1.7 x 1 inch, indicate the same species, whose differential feature was the lateral tooth, single in both valves. Smith suggested this single tooth was merely an aberration, and that a specimen in the British Museum from Melbourne also showed this peculiarity.

#### VELESUNIO SHUTTLEWORTHII.

(Plate iii., fig. 5; pl. iv., fig. 5.)

1855. *shuttleworthi*, *Unio*, Kuster, Conch. Cab. (Mart. & Chemn.), continued, ix. (2), lief. 147, pl. xlv., fig. 2 (name on cover), ex-Charpentier MS. Australia = Tasmania: here determined.
1856. *shuttleworthi*, *Unio*, Kuster, Conch. Cab. (Mart. & Chemn.), continued, ix. (2), (lief. 150), p. 152.
1859. *vittatus*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., iii., 153. Australia = Tasmania: here selected.
1860. *vittatus*, *Unio*, Lea, Journ. Acad. Nat. Sci. Philad., iv., 249, pl. xxxviii., fig. 128, March.
1865. *moretonicus*, *Unio*, Reeve, Conch. Icon., xvi., pl. xxiv., sp. & fig. 118. April. Tasmania and Moreton Bay.



1881. *shuttleworthi*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 311.  
 1889. *legrandi*, *Unio*, Petterd. Papers Proc. Roy. Soc. Tasm., 1888, 81. (Not Proc. Roy. Soc. Tasm., 1887, 22, where it does not occur.) Tasmania.  
 1914. *vittatus*, *Diplodon*, Simpson, Cat. Naiades, iii., 1296.  
 1914. *australis* var. *legrandi*, *Diplodon*, Simpson, Cat. Naiades, iii., 1298.  
 1914. *moretonicus*, *Diplodon*, Simpson, Cat. Naiades, iii., 1300.  
 1921. *australis*, *Diplodon*, May, Check List Moll., Tasm., 21.  
 1923. *australis*, *Diplodon*, May, Illustr. Index Tasm. Shells, pl. ix., fig. 11.

The Tasmanian mussel or rather mussels have always caused trouble, as when Reeve named his *Unio moretonicus* in 1865 he gave as localities, "Tasmania and Moreton Bay." The name selected would imply that the type locality should be Moreton Bay, but unfortunately no mussel agreeing with the figure is known from that locality. As a matter of fact the figure does not portray the Tasmanian shell too well, so that Simpson has even written, "It is quite probable that he had before him a *Unio obesus blandingianus* from Florida, as his figure and brief, incomplete description absolutely agree with that."

Tenison Woods agreed that the localities Moreton Bay and Tasmania for the one species were unacceptable, and then Petterd (Papers and Proc. Roy. Soc. Tasm., 1888, 81, 188) cut the Gordian Knot by naming the Tasmanian shell *Unio legrandi*. A curious complication in this reference must be noted here. In the Australian Museum is a specimen labelled "type" "*Unio legrandi* Petterd, Proc. Roy. Soc. Tasm., 1887, 22." Nothing like this occurs at the place cited, and it seemed inexplicable until it was found in the Zoological Record carefully recorded for the year 1887. Search through sets of reprints soon located it, and it appears that the paper was set up as the first paper of 1887, and then withheld for a year and included in the 1888 volume, the pagination altered, but little else changed. Simpson cites the earlier reference, as well as the correct one.

The reason may have been R. M. Johnston's antagonism, as following Petterd's published account appears a long diatribe by the first-named concerning all Petterd's work, and a special paper endeavouring to show the immense variation in the mussels (Papers Proc. Roy. Soc. Tasm., 1888, pp. 95-96, 2 pls.). Very recently May has included two species, noting that the second might be only a variant, much smaller and narrower, but unfortunately his nomination is altogether at fault. The larger one he calls *australis* (including var. *legrandi*) and the smaller *mortonicus* (through mental confusion with A. Morton, a famous Tasmanian naturalist). The smaller one is quite unlike Reeve's figure of *moretonicus* and resembles shells from Mount Kosciusko, New South Wales, and these suggest relationship with the Neozelanic mussel known as "*zelebori*."

While as written above the figure of *moretonicus* is doubtfully prepared from a Tasmanian shell, the earlier *shuttleworthi* of Kuster is very like, agreeing in detail, a notable feature being the spaced growth periods.

The Tasmanian species is a little winged, the posterior end somewhat abruptly truncate, the posterior ridge elevated, the anterior end narrowed and rounded. It is never so swollen as Northern N.S.W. shells, and is always a different shape. The shell varies in thickness, and is sometimes rather solid for this genus, and then the teeth are correspondingly stouter.

## VELESUNIO EVANSI.

(Plate iii., figs. 6, 7; pl. iv., figs. 6, 7.)

1864. *evansi, Unio (Alasmodon)*, A. Adams & Angas, Proc. Zool. Soc. (Lond.), 1864, 39. June 24. Lagoon of the Lower Murray River, Australia.
1867. *evansi, Unio*, Sowerby, Conch. Icon. (Reeve), xvi., pl. lvi., sp. & fig. 285. June. Same locality and collection; type figured.
1881. *evansi, Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool. xvi., 312.
1914. *evansi, Diplodon*, Simpson, Cat. Naiades, iii., 1303.

No series of this form is available at present though Angas remarked upon their uses by the natives many years before the species was given a name (Savage Life and Scenes in Australia and New Zealand, i., p. 55, 1847).

Apparently it is a compressed shell, as Sowerby's note says, "A rounded square, rather flattened," and "thin, depressed," though the figure suggested a somewhat obese shell. Two specimens agree fairly with the illustration and description, but one is juvenile and the other a little aberrant, and might even belong to a different species. The juvenile is a little more winged than the Tasmanian species, and even at this stage "more square."

Specimens from the National Museum, Melbourne, collected by Blandowski at Reedy Lake, junction of Murray and Darling Rivers, N.S.W., and named as *H. ambiguus* agree absolutely with the above cited figure.

## Genus WESTRALUNIO NOV.

Type *W. ambiguus carteri* nov.

All the South-west Australian specimens are small and of the "*ambiguus*" shape, but with strong teeth. Comparison with the figure of *ambiguus* indicated more exactly the West Australian shells than East Australian as commonly accepted. Consequently, Philippi's name is here restricted to the South-west Australian group, but as differences are noted in the series studied the generic characters are here prepared from specimens collected by Mr. Tom Carter, which are here distinguished for the sake of accuracy as *W. a. carteri*. Shells scarcely winged, oblong, posterior end obliquely truncate, anterior rounded, ventral edge little rounded; beaks smooth. Teeth smooth; pseudocardinal in right valve elongate, stout, coarsely grooved, fitting into a similar socket in the left valve, the internal tooth stout and grooved, the external one small, flattened and disappearing; the long blade-like lateral in the left valve is slightly grooved and fits into a deep groove in the right; the external tooth tending to disappearance, and the internal one large and prominent. The muscle scars are well impressed, sometimes deeply so, the anterior retractor pedis and the protractor pedis both being small and confluent with the adductor; posterior scars light but little impressed; dorsal scars two or three deep pits.

## WESTRALUNIO AMBIGUUS.

(Plate iii., fig. 8; pl. iv., fig. 8.)

1847. *ambiguus, Unio*, Philippi, Abbild. Conch., iii., Unio, pl. iii., fig. 2, p. 7 (47), ex-Parreyss MS. (November). Nova Hollandia = West Australia.
1861. *philippianus, Unio*, Kuster, Conch. Cab. (Mart. & Chemn.), continued, ix. (2), 235. New name for *ambiguus* Philippi.

Comparison of a series of mussels from South-west Australia shows that *ambiguus* was almost certainly a West Australian shell. Specimens have been examined from the Victoria Reservoir, in the Darling Ranges, 12 miles east of Perth, from the Canning River, near Perth, from the Collie River, Vasse River, Warren River, Frankland River, and King George's Sound. The three last-named series approximate most closely to Philippi's figure and description, and King George's Sound is here selected as the restricted type locality. The specimens from the Victoria Reservoir are larger and more elongate and are here named *W. a. carteri* subsp. nov., and the generic characters have been written up from this subspecies. The typical form is small, rather solid, rather plump, anterior end broadly rounded, posterior rather sharply truncate, posterior ridge rounded. Teeth stout, muscle scars deeply impressed. Smith, in the Zoology of the Erebus and Terror, published a figure on plate iv., to which he ascribed the name of *U. moretonicus* Reeve, giving the locality as "Australia" (Membridge River), presented by Sir J. Richardson. I have not exactly determined the locality "Membridge River," but it is apparently somewhere in the Northern Territory, perhaps near Victoria River. Specimens agreeing very closely with Smith's figure were collected by Dr. H. Basedow in the area between Port Darwin and Katherine River, Northern Territory, and their shape recalls that of these southern West Australian shells, but the hinge does not show the coarse teeth, and they seem to represent the true *angasi* in a degenerate ally.

Genus ALATHYRIA nov.

Type *A. jacksoni* nov.

Simpson placed the members of this group, which he called *Diplodon shuttleworthii* Lea, under the section *Cucumaria*, with the type of which genus they have little in common. He allowed *profugus* Gould to remain in his complex section *Hyridella*, whereas it appears to belong here. The generic characters are well marked conchologically. Shells large, swollen ovals, more or less winged posteriorly, this feature more noticeable in the juvenile, thick, beaks antemedian, not wrinkled; teeth strong, well developed; muscle scars well marked but a little variable in the species. The anterior retractor-pedis is small and sometimes well indicated, while the protractor-pedis is sometimes small and separated, but later become connected and larger.

Simpson wrote: "Beak sculpture consisting of strong, irregularly radiate, curved, nodulous bars," as the group character, and then in the specific description, "beaks low, subcompressed, sculptured, with radial bars, which curve towards each other." As locality he gave "Australia," a somewhat meaningless term.

Frierson (Nautilus, xxii., 1908, 118) has reiterated that "*Diplodon shuttleworthii* Lea, has a deeply and coarsely sulcated disc"; also regarding "Australia" as unworthy of subdivision further.

These statements are very puzzling, as large numbers of the so-called *shuttleworthii* are available from 20 mills. upwards, and, though none has a completely uneroded beak, there is no sign of sulcation present. After this was written, to my astonishment, I found that Simpson's *shuttleworthii* was undoubtedly a very slight variant of *novae hollandiae*, the measurements agreeing exactly, while study of the detailed description leaves no doubt whatever. It is then even more curious to reconcile Frierson's statements, as no Australian conchologist would confuse the two species, and Frierson asserts his shells were both labelled *angasi*, a remarkable error.



This group is called *Hyridella angasi* (Reeve), by Cotton and Gabriel, a Victorian locality, Cramenton, being added.

*Note.*—Internally the anterior portion of the shell is thickened and flattened ventrally, while the posterior portion is thin and swollen, suggesting a brood pouch.

ALATHYRIA PROFUGA.

(Plate iii., fig. 9; pl. iv., fig. 9.)

1851. *profugus*, *Unio*, Gould, Proc. Bost. Soc. Nat. Hist., iii., 295 (dated November, 1850), Hunter's River, New South Wales.  
 1852. *profugus*, *Unio*, Gould, United States Expl. Exped., xii., 429 (fig. 543, 1862).  
 1881. *profugus*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 310.  
 1914. *profugus*, *Diplodon*, Simpson, Cat. Naiades, iii., 1299.

This fine species has been called *shuttleworthi* or *angasi*, but the correct name seems to be one here selected. Three forms, which are here given specific rank, can be separated, the coastal form from New South Wales being typical.

Shell elongate-oval, anterior end rounded and narrowed, posterior end a little broader but little winged, posterior ridge flattened and negligible; shell thick, beaks apparently smooth; sculpture concentric growth lines well marked and forming shallow ridges. From the thickened flattened teeth and very deeply impressed muscle scars the typical form does not appear to grow to such a large size as it congeners, the left laterals coalescing and save for a slight duplication posteriorly appearing to be single and the pseudocardinals likewise.

ALATHYRIA PERTEXTA sp. nov.

(Plate iii., fig. 10; pl. iv., fig. 10.)

1856. *shuttleworthi*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., viii., 94. Australia. Not *Unio shuttleworthi* Kuster, 1855, ante.  
 1857. *shuttleworthi*, *Unio*, Lea, Journ. Acad. Nat. Sci. Philad., iii. (2), 304, pl. xxviii., fig. 19.  
 1866. *shuttleworthi*, *Unio*, Sowerby, Conch. Icon., xvi., pl. xxxvii., fig. 167. March.  
 1881. *angasi*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 307. Specimens from Brisbane River and perhaps those from River Isaacs.

This very fine shell from mid and south Queensland rivers differs from the coastal New South Wales *profuga* in being more elongate and perhaps growing to a larger size. Sowerby's figure quoted above represents this elongated shell, as also Lea's, and South Queensland specimens were commonly available at that time.

Shell elongate oval, anteriorly rounded, posteriorly winged and elongate, dorsal margin a little excavate anterior of the umbo, ventral margin rather straight; posterior ridge elevated, posterior area flattened and sometimes scantily radially wrinkled; sculpture of remainder of shell concentric striae only becoming wrinkled towards the margins and less rugose than in preceding species.

ALATHYRIA JACKSONI sp. nov.

(Plate iii., fig. 11; pl. iv., fig. 11.)

Many years ago Hedley made a note in his copy of Smith's account of Unios that shells from the interior of New South Wales were more winged

than coastal ones. A very fine collection made by Mr. Sidney W. Jackson from the Barwon River showed all sizes, and the "winging" of the juvenile is very striking, the shape of the shell separating this species at sight from its congeners, *profuga* and *pertexta*.

Shell large, elongate oval, fairly strongly winged and posteriorly somewhat acuminate; anteriorly rounded and the ventral margin nearly straight; posterior ridge elevated and rounded; posterior slope flattened and thinned out. Beaks apparently smooth, remainder of shell rather finely regularly concentrically striate, growth periods not strongly differentiated. Juvenile shells much more strongly winged, almost wedge-shaped and comparatively thin. Teeth variable in strength, according to weather growth conditions; sometimes the pseudocardinals short and stumpy, at others large and prominent; often the left laterals fuse most of their length; muscle scars deeply impressed; the protractor-pedis small and sometimes free.

#### Genus CENTRALHYRIA nov.

Type *Unio stuarti* A. Adams & Angas.

This genus is provided to include all the mussels from Central Australia, ranging into the Fitzroy River in the north-west until Fitzroy River in Queensland, which have generally been classed as one species. Probably many forms will later be recognised as the size variation is great.

The superficial aspect recalls that of *Anodonta*, and the teeth are slender, delicate and sometimes obsolete through growth; the shell itself being thin until it reaches very large size. Shell elongate, thin, of medium convexity, rounded anteriorly, somewhat acuminate posteriorly, the posterior ridge rounded; the ventral edge subparallel to the dorsal, rounded. Beaks smooth, the sculpture being concentric growth lines between which fine concentric striae run wrinkly.

The teeth are normal, but through degeneration sometimes appear obsolete; at others only a weak pseudocardinal persists in the right valve; the laterals in the left valve very slender, laminar and close together. The muscle scars are very lightly impressed, the anterior adductor showing a rounded protractor-pedis which elongates with age, while the anterior retractor-pedis is indistinguishable in some forms; in others it can be detected as a small semi-fused scar.

#### CENTRALHYRIA STUARTI.

(Plate iii., fig. 12; pl. iv., fig. 12.)

1864. *stuarti*, *Unio* (*Alasmodon*), A. Adams & Angas, Proc. Zool. Soc. (Lond.), 1863, 417, April 20, 1864. Lagoon, near Mt. Margaret, Central Australia.
1866. *stuarti*, *Unio*, Sowerby, Conch. Icon., Reeve, xvi., pl. liv., fig. 279. November. Immature. Port Jackson. Mus. Cum. in Brit.
1867. *stuarti*, *Unio*, Sowerby, Conch. Icon., Reeve, pl. lv., fig. 279a. June. Fully grown, ex Mus. Angas.
1870. *stuarti*, *Anodon*, Sowerby, Conch. Icon., Reeve, xvii., pl. xxxiv., fig. 136 a.b. June. Hab. ? Juv. in B.M.
1881. *stuarti*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 311.
1914. *wilsonii*, *Diplodon*, Simpson, Cat. Naiades, iii., 1302.

The type locality lies about 136° E. Lat. and 28° 30' S. Long., west of Lake Eyre, but Tate later records specimens from Newcastle Waters, apparently taken on Stuart's second expedition.

The second figure given by Sowerby, either of the type or a paratype,

agrees with specimens from Algeuckinna, a locality close to the type locality. These were recorded by Hedley (Trans. Roy. Soc. South Aust., xxix., 1905, 161) under the name *Diplodon wilsonii*. While that species resembles the present one it cannot be regarded as conspecific, the teeth in this case becoming obsolete with age, while in *wilsonii*, as here understood, they become stouter and the shell thicker.

The Algeuckinna shells are elongate, anteriorly rounded, posteriorly rather angulate, ventral margin rather straight, subparallel to the dorsal margin; the posterior ridge is low and flattened, the growth ridges irregularly pronounced, beaks apparently smooth and the whole shell thin. The teeth are very delicate, thin and laminar, almost disappearing with age; muscle scars very lightly impressed.

#### CENTRALHYRIA WILSONII.

(Plate iii., figs. 13, 14; pl. iv., figs. 13, 14.)

1859. *wilsonii*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., 153. May. Eastern branch of Isaac's Plains, New South Wales.  
 1860. *wilsonii*, *Unio*, Lea, Journal Acad. Nat. Sci. Philad., iv., 256, pl. 40, fig. 137. March.  
 1868. *wilsonii*, *Unio*, Sowerby, Conch. Icon. (Reeve), xvi., pl. 88, lxxxviii., fig. 472. September. (Copied from Lea.)  
 1881. *wilsonii*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), xvi., 311.  
 1914. *wilsonii*, *Diplodon*, Simpson, Cat. Naiades, iii., 1302.

The type locality cited appears to be in what is now called Queensland, inland a little, midway between St. Lawrence and Bowen, Isaac's River running into the Mackenzie River, which is itself captured by the Fitzroy. The shell figured by Lea was a small fairly symmetrical oval measuring 1.9 x 1 x .6 inch, and the teeth are thus described "cardinal teeth small, lamellar, oblique, double in the right and single in the left vale (sic) lateral teeth long, acicular and nearly straight."

Specimens from "Gladstone," Mary River, Emmett Downs, Hughenden and Longreach differ a little among themselves, but all show a larger growth, more swollen and deeper posteriorly, and in the largest specimens strong acicular teeth persist. Consequently, until much more study has been undertaken, the species should be kept separate, and it is very possible that the series here lumped under *wilsonii* will be divided. Shells from the May River, North-west Australia, though of the same thin texture and having similar delicate teeth, again differ in shape, being much deeper posteriorly, the ventral margin distinctly sloping posteriorly, while the dorsal margin is there heightened. This subspecies may be called *C. wilsonii caurina* nov.

#### CENTRALHYRIA ANGASI.

(Plate v., fig. 4; pl. vi., fig. 1.)

1867. *angasi*, *Unio*, Sowerby, Conch. Icon. (Reeve), xvi., pl. lv., fig. 282, ex Lea MS. June. Strangway River, North Australia.  
 1864. "*angasana*, *Alasmodon*, Lea," A. Adams & Angas, Proc. Zool. Soc. (Lond.), 1863, 417, April 20, 1864, *nom. nud.* Central Australia.  
 [1870. *angasii*, *Anodon*, Sowerby, Conch. Icon. (Reeve), xvii., pl. xxxii., fig. 127, June, ex "Lea, Obs." South Australia.]  
 1881. *angasi*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), xvi., 307. Includes common Eastern species *profugus*, etc.

Smith utilised this name for "the largest of the Australian species,"



concluding that it "was described by Reeve from what I take to be the rather young state of this form." It is worthy of note that when A. Adams and Angas described *Unio stuarti*, they observed "is the only Naiad, besides *Alasmodon angasana* of Lea, yet discovered in the regions traversed by the explorers."

Lea protested later that he did not remember this nomination. Although Sowerby's figure suggests the large Eastern shell, the description "thin . . . bluish within with thin laminar teeth" and the locality do not agree, and the described shell is easily recognised when Northern Territory shells are examined. The figure suggests that the umbones are wrinkled, but the description reads "umbones smooth," which is correct. Shell a little elongate, oval, anteriorly rounded, posteriorly acuminately truncate, dorsal margin sloping and ventral margin nearly straight, posterior ridge flattened, but the posterior slope rather marked. Beaks apparently smooth, whole shell being fairly smooth, though growth lines are apparent, while a fine, but very subdued striation occurs. Teeth long and acicular, the pseudocardinals especially so, the pair in the right valve being long and subequal, the corresponding tooth in the left valve agreeing, but in one case a perfect accessory tooth has developed, while in an old shell the single tooth is in danger of extinction. The subgeneric name *Aparcthyria* is proposed for this species.

The shell figured in the Zoology of the "Erebus and Terror," pl. iv., fig. 2, from the Membridge River, Australia, under the name *Unio moretonicus* Reeve & Smith, is here determined as a Northern Territory species, and its rounded form appears to be due to poor conditions of living, and specimens differ from typical *angasi* in being shorter, more rounded, more solid, the hinge line more curved, the pseudocardinals shorter, and may be sub-specifically separated as *C. angasi subjecta* nov.

#### CENTRALHYRIA BEDNALLI.

1882. *bednalli*, *Unio*, Tate, Trans. Proc. Roy. Soc. South Austr., v., 56. December. River Adelaide, at the ford, Northern Territory.

This species has not been figured, though Frierson (*Nautilus*, xxi., 118, February, 1908) reported that from examination of a fine series from Bednall it was not synonymous with *australis*, but was much nearer to *wilsonii* Lea (= *stuartii* Adams & Angas), but he does not give the locality whence the specimens were obtained.

Tate had written "differs from *U. stuartii* in being more tumid, less inequilateral, and in its truncated, not acuminate, posterior margin. Epidermis always blackish brown. Measurements, 79 x 40 x 30 mm.; anterior 23; posterior 56. Measurements of a large *stuartii* from Newcastle waters, 107 x 52 x 30; anterior 28; posterior 79."

It seems more probable, however, that Tate's shell is a form of the true "*angasi*," but in the same essay he recorded *angasi* and a form near *angasi*, so the case must be left for later solution.

#### Genus HYRIDELLA.

1840. *Hyridella*, Swainson, Treat. Malac., pp. 285, 380. May. Haplotype, *Unio australis*, "Lamarck."

On page 285, Swainson wrote: "The peculiarities of Lamarck's *Unio australis* (*Hyridella* Sw.), and its affinity to *Iridea*, lead us to arrange it as the anodontine type of the *Hyrianae*, although it may possibly be an

aberrant example of *Iridea*; the bosses, however, are not striated, and the whole shell has very much the aspect of an *Anodon*."

The fuller diagnosis on page 380 reads: "Transversely oval; bosses not sulcated; posterior margin elevated and winged; one cardinal and one lateral tooth in each valve."

The comparison with *Anodon* might suggest that Swainson had before him a specimen of the "*balonnensis*" series, but it is an early date for that kind of shell; it might even have been the Tasmanian species. The reference to the teeth is, however, fatal to its acceptance, as also the phrase, "posterior margin elevated and winged," which is scarcely applicable to any of this group. Swainson was notoriously careless, and it is even possible that he did not have before him an Australian shell, so that the name cannot be utilised at present for any of our groups.

As long ago as 1908, Frierson, a specialist in American freshwater mussels, contributed some "Notes on Some Australian Unionidae" (*Nautilus*, xxi., pp. 118-9, February, 1908), and observed "*angasii* Sow.," "shows a beak having not a trace of radial sculpture, but only a fine concentric sulcation. Hence the shell . . . strictly speaking, is not even a *Diplodon*."

A little later Ortmann, another famous student of American freshwater mussels, in the same Journal (xxv., p. 100, January, 1912), discussed the Anatomy of the Najad *Hyridella australis* (Lamarck) (= *Diplodon australis*), concluding, "*Hyridella* must be generically allowed, but it is close to *Diplodon*." The specimens examined were from Gippsland, Victoria, and were apparently of the *Vesunio* series, but the only specimens in this museum from Gippsland do not belong to this group.

#### GENUS HYRIDUNIO NOV.

##### Type *H. australis drapeta* nov.

As *Hyridella* cannot be used with exactitude for any Australian group, although Lamarck's *Unio australis* was named in connection with it, the above name is introduced for the shell agreeing best with Hanley's figure and Lamarck's description. In order that there can be no mistake in the genus proposed, I am giving as type a Queensland form which notably differs from the New South Wales series in being more elongated; and the generic characters are drawn up from it.

Shell stout, compressed elongate, scarcely winged, posterior ridge rounded, sculpture concentric lines with growth stages not strongly marked, but striae notably crinkled. Beaks placed anteriorly, eroded, but apparently wrinkled, ridges being decipherable upon the eroded surface.

Teeth stout, the right pseudo-cardinals being both strong, the inner one developed into a rugose conical tooth, the outer one less stout, the right lateral being strong and blade-like; the left pseudocardinal is correspondingly a strong rugose conical tooth, and the left laterals are fused umboned, but separate posteriorly. Anterior muscle scars deeply impressed, the posterior as usual lightly marked; the anterior adductor rather small, the anterior retractor-pedis small, separated and deep forming a pit; the protractor-pedis small, roundish and connected; dorsal scars pits in a line under the beaks sometimes confluent.

While the general diagnosis reads somewhat like that of *Rugoshyria*, the whole facies of the shell is dissimilar, the solidity and shape of the present group contrasting vividly with the thinness and elongation of that genus. The hinge line of *Hyridunio* is also much more curved, and consequently the pseudo-cardinals more perpendicular.

## HYRIDUNIO AUSTRALIS.

(Plate v., figs. 1, 2; pl. vi., figs. 2, 3.)

1819. *australis*, *Unio*, Lamarck, Hist. Anim. s. Vert., vi. (1), 80. July. New Holland.

This species has given trouble ever since its description, which reads: "U(nio) testâ transversim ovatâ, medio subsinuata; extremitatibus lateralibus rotundatis; dente cardinali parvo, compresso, subacuto. Habite à la Nouvelle Hollande. Mus. no. Largeur. 55 millimetres." Smith commented: "Lamarck's diagnosis is so brief, that it is utterly impossible to know what species he had before him. I therefore adopt Phillipi's idea of it. He was the first to describe and figure a shell which he believed to be the *U. australis*."

Hanley, however (Recent Shells, 1843, 192, pl. 25, fig. 21), had copied Lamarck's description and figured a shell agreeing with it, and it is well known that Lamarck's shells were studied by Hanley, and probably Lamarck's type is thus figured. This was published before Phillipi's account appeared, so that Phillipi's idea had been anticipated by a more exact application, while it may be noted that Swainson had used Lamarck's name still earlier for a shell which again appears to differ.

A species answering better to Lamarck's description and Hanley's figure occurs near Sydney in the coastal rivers of New South Wales, and is here so identified. Shell elongate oval, thick, both ends rounded, compressed, the posterior ridge rounded and flattened, medially with a rounded depression; beaks eroded but showing traces of radial ridging, a very fine wrinkled concentric striation succeeding, growth stages ill-defined.

A specimen from Jamberoo, near Kiama, N.S.W., is a little more winged and therefore comparatively deeper, while from Lilydale, Victoria, a fully adult specimen is a little smaller, less winged, the pseudocardinals less erect and more rugose, the anterior muscle scars smaller, the anterior retractor-pedis pit notably so. This apparently represents a southern subspecies which may be named *Hyridunio australis orion* subsp. nov.

From the Brisbane River a more elongated shell of the same species offers a deeper and larger anterior retractor-pedis pit and a smaller protractor-pedis scar; the teeth are stouter and the laterals longer. It is here named *H. australis drapeta* subsp. nov.

## HYRIDUNIO RENUTUS sp. nov.

(Plate v., fig. 3; pl. vi., fig. 4.)

From the Latrobe River, Gippsland, Victoria, is a specimen quite different from the normal species in being notably winged, consequently of a very different shape. It is even more compressed, and the anterior muscle scars are very deeply impressed, and the pseudocardinals thickened and less conical, the outer one in the right valve being almost obsolete, while the left pseudocardinal is almost subdivided into two; the laterals in the left valve are reduced to two small laminar teeth distant from the umbo.

The shell is anteriorly rounded, posteriorly winged and broadened, the ventral margin almost straight, the dorsal margin elevated; the medial sinuation is weak but present and the posterior ridge broad and flattened.

Specimens from the National Museum, Melbourne, under the name *Propehyridella cultelliformis* (Conrad) from Tarra Creek, Tarraville, near Port Albert, Victoria, belong to *Hydrunio* and suggest that the above-named specimen may be abnormal as these are a little winged. The above name



will be available, however, as they have nothing whatever to do with *cultelliformis*.

MYCETOPUS RUGATUS.

1868. *rugatus*, *Mycetopus*, Sowerby, Conch. Icon. Reeve, xvi., pl. iii., fig. & sp. 7. March. Victoria River, Australia.  
 1875. *rugatus*, *Mycetopus*, Smith, Zool. Erebus and Terror Moll., p. 3, pl. 4, fig. 1. Mus. Brit. specimen.  
 1881. *rugatus*, *Mycetopus*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 313. (Collector, Capt. Wickham).  
 1914. *rugata*, *Solenaiia*, Simpson, Cat. Naiades, i., 462.

Smith, in 1881, commented: "It is very remarkable that Australia and South America should possess species so much alike as *M. siliquosus* and the above."

Simpson (Cat. Naiades, i., 1914, 462), calls this species *Solenaiia rugata* (Sowerby), judging from figure above, with the comment: "Said to come from Victoria River, Australia. I am a little in doubt about the locality."

Although no further specimens have been secured the locality appears acceptable, and Smith figured the hinge in connection with the Mollusca of the "Erebus and Terror," commenting: "Possibly when the animal inhabiting this shell is examined it will prove to be an *Anodonta*. The shell scarcely gapes at the anterior extremity."

The shell does not look much like a *Solenaiia*, and seems to be an elongate relation of the *angasi* or *stuarti* series, but obviously distinct from either. To relieve it of its present very anomalous position the new generic name *Lortiella* is introduced.

The curious inclusion of this species in the zoology of the "Erebus and Terror" puzzled, but a little investigation solved a previously unattacked problem. Four quarto plates, supposed to have been prepared for the zoology of the "Erebus and Terror" in the forties of the last century, were issued some thirty years later, in 1874, with a scant letterpress by Smith, ignorant of their exact preparation. In the few notes he admits that three are of New Zealand shells, though the fourth is of Australian with one Cape of Good Hope shell. On this plate iv. this species is figured from the Victoria River, North Australia, and this plate iv. shows two octavo plates prepared on the same stone and obviously nothing to do with the other three plates, nor with the zoology of the "Erebus and Terror." Eighteen species are figured from various localities, such as Victoria River, Dupuch's Island and Blackwood Bay, mostly presented to the British Museum by Sir J. Richardson. Richardson received fishes, shells, etc., from these localities, collected by Lieutenant Emery, of the Beagle. The captain of the Beagle was Captain Wickham, and later Captain Stokes, who published an account, entitled, "Discoveries in Australia." Therein he mentions the "muscles" met with on the Victoria River, and later (ii., p. 176) dealing with the zoology of Dupuch's Island, wrote: "The specimen of the species of *Helix* I have above mentioned was found by Mr. Dring, one of our most successful collectors in that department. In the appendix are figured some of the new shells discovered during the voyage." There is no description nor plates in the appendix, and it is now certain that the plate iv. of the zoology of the "Erebus and Terror" is composed of two plates prepared from the new shells discovered on the voyage of the Beagle. All the species are undoubtedly North Australian, and the "Cape of Good Hope" determination of Smith is incorrect.

In 1881, Smith gave Captain Wickham as collector of some of the specimens of the present species in the British Museum.

LORTIELLA FROGGATTI sp. nov.

(Plate v., fig. 5; pl. vi., fig. 5.)

When the well-known entomologist, Mr. W. W. Froggatt, collected for Mr. W. Macleay, in North-west Australia, he secured a series of land shells, novelties being described by Cox, Smith and Añcey. In the Macleay Museum, a series of mussels collected at the same time were recently noted, and these proved of absorbing interest in view of the preceding account of *Mycetopus rugatus*. Obviously a smaller relative of the older puzzling species, they prove the suggestion as to their alliance to be correct. The shell is small, thin elongate, narrowed anteriorly, winged posteriorly, with as nearly straight ventral margin; the anterior end is produced and rounded, the posterior somewhat acuminate lengthened, the ridge being rounded, the posterior area flattened. The whole surface is strongly sculptured with growth lines, obscure radial rays being faintly observed, traces of zigzag surface threads also occurring. The teeth are thin and delicate, the laterals being elongate, the pseudocardinals being small and tending to disappear, the right pair being distinguishable in the juvenile, but one only stronger in the adult. The Lennard River is the type locality.

Genus RUGOSHYRIA nov.

Type *Unio paramattensis* Lea = *Unio depressa* Lamarck.

A genus of small mussels, elongate in shape, shells of comparative thinness, teeth strong and a deep pit under the extremity of the pseudo-cardinals. Beaks with radial ridges, otherwise the only sculpture is concentric growth lines and striation. The laterals are slender, the external one in the left valve being smaller at the ends and fused umboned; the pseudocardinals are short and stout, the single one in the left valve being roughened and erectly conical almost separating into two; in the right the outer of the corresponding pair is small and flattened, the inner one erect, conical, and grooved. The anterior muscle scar is deeply impressed, and the protractor-pedis is small and coalescent with the adductor. The deep pit which attracted attention almost one hundred years ago appears to be the seat of the anterior retractor-pedis, and is seen in the Australian species having plicate beaks, and is not confined to the Australian species, being noted in *U. guppyi* Smith, from the Solomon Islands.

RUGOSHYRIA DEPRESSA.

(Plate v., figs. 6, 7; pl. vi., figs. 6, 10.)

1819. *depressa*, *Unio*, Lamarck, Hist. Anim. s. Vert., vi. (1), 79. July. Rivers of New Holland. (In Mus. & Lam. coll.).
1859. *mutabilis*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., iii., 152. May. Brisbane Water, Austr.; New Zealand and Murray River.
1860. *mutabilis*, *Unio*, Lea, Journ. Acad. Nat. Sci. Philad., iv., 248. March, pl. xxviii., fig. 127. ? Reeve, C. I., xvi., pl. xxiv., sp. fig. 112. April, 1865.
1862. *paramattensis*, *Unio*, Lea, Proc. Acad. Nat. Sci. Philad., iv., 176. April-May. Parramatta River, New South Wales.
1866. *paramattensis*, *Unio*, Lea, Journ. Acad. Nat. Sci. Philad., 2nd ser., vi., 60, pl. xx., fig. 59. July. (Separate May).



1881. *depressus*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 308 (includes *cultelliformis* Conrad).  
 1914. *cultelliformis*, *Diplodon*, Simpson, Cat. Naiades, iii., 1300.  
 1914. *mutabilis*, *Diplodon*, Simpson, Cat. Naiades, iii., 1308. Murray River shells.

Lamarck's description reads: "U(nio) testa ovata-oblonga, depressa, tenui, intus caerulescente; laterum extremitalibus rotundatis. Habite dans les rivieres de la Nouvelle Hollande. Mus. no. Mon. cabinet. Epiderme brun. Largeur 52 millimetres."

Simpson got rid of Lamarck's species name by the plea that Donovan previously had named a freshwater mussel *Mya depressa*, a false procedure. He then utilised Conrad's *cultelliformis* for Lea's *paramattensis*, but the former was described from the Bogan River, a member of a different river system to that carrying *paramattensis*. Simpson then preserved Lea's *mutabilis* as a distinct species, placing it in the section *Cucumaria*.

The shell here recognised as Lamarck's species from Delessert's illustration (Recueil Coquilles Lam., pl. 12, fig. 5, 1841) varies a little in shape. Specimens from the Parramatta River are here taken as typical *depressa*, and are a little elongate, thin, posterior ridge rounded, slightly winged; concentric striation is pronounced, but growth stages are not strongly differentiated. Umbones generally eroded, but juvenile specimens show marked radial ridges, missing on the posterior region.

A large series collected by Helms on the Grosse's Plain Creek, Moonbar Run, Mt. Kosciusko, between 3,000-3,500 feet altitude, show subspecific features, being shorter and deeper and the teeth stronger. They may be called *R. depressa monticola* subsp. nov.

May has figured (Illustr. Index Tasm. Shells, 1923, pl. ix., fig. 12) a form of this species, under the name *D. mortonicus* Reeve, commenting, "possibly only a variant, much smaller and narrower." The figure is very like the Kosciusko form, and as it has nothing to do with *mortonicus* (recte *moretonicus*) it may be named *R. depressa sodalis* subsp. nov.

Apparently, following Simpson, Cotton and Gabriel have used the name *Propehyridella cultelliformis* for this species, giving various localities in New South Wales and Victoria, but their first record, "Richmond River, N.S.W. (153 mm. x 71 mm.\*)" is incorrect; it would be a fine shell, but the only species with these measurements is *C. novaeollandiae* Gray. Specimens received from the National Museum, Melbourne, collected in the Mitchell River, Bairnsdale, Gippsland, Victoria, are larger and more elongate than Kosciusko shells, and may be called *R. depressa vicinalis* subsp. nov.

The range of the species northward is at present unknown, as a specimen from Kenilworth, Mary River, Queensland, is undoubtedly specifically separable, being larger, more obese, posterior ridge elevated and pronounced and the anterior end angulately produced. It is here named *R. interserta* sp. nov.

A very interesting shell from the Bloomfield River, North Queensland, is, however, very like the typical form, but is more compressed, the beaks more anteriorly placed, the ridge more flattened and the anterior end more rounded. It is here named *R. aquilonalis* sp. nov., as specimens from the Solomon Islands determined as *U. guppyi* Smith, are of the same facies, and the North Queensland shell may be more closely related to those than to the southern shells. Simpson (Cat. Naiades, iii., 1914, 1156) placed the species *guppyi* in the genus *Cristadens* on account of the surface sculpture. The North Queensland shells show traces of similar sculpture, but its value is problematical.



## RUGOSHYRIA CULTELLIFORMIS.

(Plate v., fig. 10; pl. vi., fig. 7.)

1850. *cultelliformis*, *Unio*, Conrad, Proc. Acad. Nat. Sci. Philad., v. (1), 10, February. Bogan River, New South Wales.  
 [1854. *depressus*, *Unio*, Conrad, Journ. Acad. Nat. Sci. Philad., 295, pl. xxxvi., fig. 2. February.]

Conrad described a *Unio* from the Bogan River, but four years later synonymised it with Lamarck's *U. depressus*, writing, "The shell I have described appears to be the adult, or a large variety of Lamarck's species," giving a copy of Delessert's illustration of the Lamarckian shell. As on the same plate he gave a figure (6) of the shell later named by Lea *U. paramattensis* his species must have differed, though recently they have been regarded as the same. Conrad's comment on the figured shell (6) reads: "This figure represents a shell sent from Australia in company with *U. napeanensis*, *Balonnensis*, etc., labelled Bogan River. It cannot be distinguished from a common variety of *U. complanatus*, yet if it inhabits an Australian river it must be a different species." Notwithstanding Pilsbry's strictures (*Nautilus*, xlv., 1931, 108) I agree with Conrad, and do not record the Australian species, under the genus *Elliptio* or *Unio*, especially as Simpson regarded Pilsbry's location in *Arconia* incorrect.

There appears to be a series of shells resembling *depressa* in the rivers of central and northern Australia, and with this series Conrad's *cultelliformis* would be associated. These are larger, more elongate, more produced posteriorly, and the name *cultelliformis* may be used until they are better known.

## GENUS PROPEHYRIDELLA.

1932. *Propehyridella*, Cotton & Gabriel, Proc. Soc. Roy. Soc. Vict., xlv., n.s., 158. April 20. Orthotype *Unio nepeanensis* Conrad.

The shell is a rather solid, short, plump oval, truncated posteriorly, rounded anteriorly, hingeline sloping, agreeing with dorsal margin, ventral margin nearly straight, little rounded; growth ridges marked but surface of shell smoothened; the beaks strongly sculptured with radial bars sloping inwards from both sides; the posterior two much thicker than the anterior four or five. The teeth are strong, the left laterals long; in one specimen one of these being suppressed, while the pseudocardinals are stout and conical; in the right valve the outer of the two small and thin, the inner large and rugose.

## PROPEHYRIDELLA NEPEANENSIS.

(Plate v., figs. 11, 12, 13; pl. vi., figs. 11, 12, 13.)

1831. *depressa*, *Unio*, Lesson, Voy. Coquille Zool., ii., 427, pl. 15, fig. 5g. Nepean River N.S.W. Not *Unio depressa* Lamarck, 1819 (ante).  
 1850. *napeanensis* (sic) *Unio*, Conrad, Proc. Acad. Nat. Sci. Philad., v. (1), 10. February. Nepean River, New South Wales.  
 1851. *dorsuosus*, *Unio*, Gould, Proc. Bost. Soc. Nat. Hist., iii., 296 (dated November, 1850). Eastern Asia. ?  
 1852. *dorsuosus*, *Unio*, Gould, United States Expl. Exped., xii., 430 (fig. 540, a.b., 1862).  
 1854. *napeanensis*, *Unio*, Conrad, Journ. Acad. Nat. Sci. Philad., iii., 296, pl. xxvi., fig. 4. February.  
 1856. *lessoni*, *Unio*, Kuster, Conch. Cab. (Mart. & Chemin.) continued, ix. (2), 135, pl. xxxvii., fig. 4. New name for *Unio depressa* Lesson, not Lamarck.

1865. *nepeanensis*, *Unio*, Reeve, Conch. Icon., xvi., pl. xxiii., sp. & fig. 110. April.
1881. *nepeanensis*, *Unio*, Smith, Journ. Linn. Soc. (Lond.), Zool., xvi., 312.
1914. *dorsuosus*, *Diplodon*, Simpson, Cat. Naiades, iii., 1289.
1914. *lessoni*, *Diplodon*, Simpson, Cat. Naiades, iii., 1296 (may be *nepeanensis*).
1932. *narracanensis*, *Propehyridella*, Cotton & Gabriel, Proc. Roy. Soc. Vict., xlv., n.s., 159. April 20. Narracan River, Gippsland, Victoria.

At present no near relation of this species is known. The Richmond River shells are larger and longer than the local topotypes and apparently represent a distinct subspecies which may be called *P. nepeanensis opportuna* nov. Specimens from the National Museum, Melbourne, collected in the backwater of Mitchell River, Bairnsdale, Victoria, by W. Kershaw, and recorded by Cotton and Gabriel as *P. nepeanensis* are large and narrower with more heavily sculptured umbones. These may be regarded as a distinct subspecies whose name will be *P. n. narracanensis* Cotton & Gabriel, as shown by specimens from the National Museum, Melbourne. The species named by Cotton and Gabriel is undoubtedly the very juvenile form of the specimens regarded by them as *nepeanensis*.

#### GENUS PROTOHYRIDELLA.

1932. *Protohyridella* Cotton & Gabriel, Proc. Roy. Soc. Vict., xlv., n.s., 159. April 20. Orthotype *Unio glenelgensis* Dennant.

This group was distinguished on account of "the peculiar sculpture occupying the greater portion of the shell," and as I had already separated it by means of the strong teeth the group must be recognised. The comment, "The corrugated sculpture, typical of freshwater mussels inhabiting quick-flowing rivers seems scarcely warranted in present-day slow-flowing Australian rivers," needs study.

#### PROTOHYRIDELLA GLENELGENSIS.

(Plate v., fig. 14; pl. vi., fig. 14.)

1898. *glenelgensis*, *Unio*, Dennant, Proc. Roy. Soc. Vict., x. (n.s.), 112, pl. iv. May. Dartmoor, Glenelg River, Victoria.
1914. *glenelgensis*, *Diplodon*, Simpson, Cat. Naiades, iv., 1290.

Shell very small, stout, oval, markedly winged, with the anterior end angulate, ventral margin rounded.

Sculpture of beaks mainly zigzag radials succeeded by concentric wavy nodules overrunning the close concentric striation, growth stages being well marked.

Teeth very strong, the pseudocardinals stout and grooved, almost denticulate, the laterals strong and roughened, the left pseudocardinal being almost duplicate.

The anterior muscle scars deeply impressed, the posterior as usual very lightly; under the edge of the pseudocardinals a very deep pit, the seat of the anterior retractor-pedis appears, while the protractor-pedis is small, rounded and confluent; only one dorsal scar under the beak. The sum of the characters and especially the strong rugose teeth demand separation.

Genus CUCUMERUNIO nov.

Type *Unio novaehollandiae* Gray.

1853. *Cucumaria* Conrad, Proc. Acad. Nat. Sci. Philad., vi., 269. Haplotype *Unio cucumoides* Lea. Not *Cucumaria* Blainville, Dict. Sci. Nat. (Levr.), ix., 173, 1830, or Lesson, Cent. Zool., 153, ante March, 1831.

The sole member of this genus is easily recognised by its large size, thick shell, elongate shape, wrinkled external sculpture; beaks with radial, anteriorly zigzag, ridges; the posterior radials continue as growth increases the shell, but the anterior zigzag ridges disappear. The adult shell is thus strongly radially ridged posteriorly behind the ridge, but smooth anteriorly, a few longitudinal striae being developed erratically in the median area; otherwise finely concentrically striate, growth periods fairly well marked; beaks at about one-sixth anteriorly; height less than half length.

Teeth stout, the left pseudocardinals (for there are two), although the outer one is very small, subconical, rugose, the left laterals fused for more than half their length umbonad, the right lateral single, stout, blade-like, a little rugose posteriorly; the right pseudocardinals (for here the two correspond), the outer small, the inner one rugose and conical.

Posterior muscle scars, as usual, lightly marked, but anterior deeply set.

CUCUMERUNIO NOVAEHOLLANDIAE.

(Plate v., fig. 15; pl. vi., fig. 15.)

1834. *novaehollandiae*, *Unio*, Gray, Proc. Zool. Soc. (Lond.), 1834, 57. Nov. River Macquarie, New South Wales. (Probably collected by Allan Cunningham.) Gray Coll.  
 [1840. *elongata*, *Naiia*, Swainson, Treat. Mal., 285. May. New Holland.]  
 1840. *cucumoides*, *Unio*, Lea, Proc. Amer. Phil. Soc., i., 285. October. Hunter's River, New South Wales.  
 1842. *cucumoides*, *Unio*, Lea, Trans. Amer. Phil. Soc., viii., 192, pl. vii., fig. 2.  
 1843. *novaehollandiae*, *Unio*, Hanley, Gen. Recent Shells, 182.  
 1852. *cumingianus*, *Unio*, Dunker, Zeitsch. für Mal., ix., 53. May 12. New Holland.  
 1856. *cucumoides*, *Unio*, Hanley, Recent Shells, 382, pl. 24, fig. 4.  
 1861. *cucumoides*, *Unio*, Kuster, Conch. Cab. (Mart. & Chem.) continued, ix. (2), 219, pl. lxxiv., fig. 1.  
 1865. *cucumoides*, *Unio*, Reeve, Conch. Icon., xvi., pl. xx., fig. 89.  
 1870. *cumingii*, *Unio*, Lea, Synopsis Naiades, 4th ed., 31, as of "Dunker Zeitschr. für Mal., 1846, 109. Richmond River." lapsus only, name does not occur.  
 1881. *novaehollandiae*, *Unio*, Smith, Journ. Proc. Linn. Soc. (Lond.), Zool., xvi., 312 = *cucumoides* Lea. Gray's types, now in British Museum, examined.  
 1914. *novaehollandiae*, *Diplodon*, Simpson, Cat. Naiades, iii., 1304.  
 1914. *shuttleworthii*, *Diplodon*, Simpson, Cat. Naiades, iii., 1306.

This remarkable mussel has a somewhat restricted range, being confined to the coastal rivers of northern New South Wales and southern Queensland. There is variation in shape and strength of sculpture, but so far no geographical quantity has been noted. An overlooked reference seems to be that of Swainson, when he recorded *Naiia elongata* from New Holland . . . "having the form of one type and the teeth of the other. This interesting species, once the property of Admiral Bligh, was purchased by



us at his sale." The single species, of which the characters have been given under the generic heading, really varies so slightly from series available at present that it becomes amazing to find Simpson including it twice in his catalogue, yet the description of "*shuttleworthii*" given by him refers to this species.

In Smith's 1881 list appear the following:—

*Unio rugulosus* Charpentier, Kuster's Con. Cab., 1855, pt. 147, pl. xlv., fig. 5, do., 1856, pt. 150, p. 154. Described from New Holland.

Simpson (Cat. Naiades, i., 1914, 277) states that the locality is wrong and that the species is "evidently Mexican or Central American."

*Unio multidentatus* Parreyss, Philippi Abbild., vol. iii., p. 46, pl. iii., fig. 4. Kuster's Con. Cab., pl. xxxvi., fig. 5. var. = *Unio fulmineus* Parreyss, Philippi, l.c., figs. 5-6. Kuster, p. 286, pl. xcvi., figs. 2-3. Australia.

Simpson (Cat. Naiades, iii., 1914, 1106/7) places both these names in the synonymy of *Parreysia corrugata* Müller, of India.

*Unio gratosus* Parreyss, Philippi Abbild., vol. i., pl. 1, fig. 5. Kuster's Con. Cab., p. 239, pl. lxxx., fig. 3. Australia.

Simpson (Cat. Naiades, ii., 1914, 993) states "Philippi's locality is evidently erroneous," and calls the species "*Nodularia gratiosa*, South-east Asia."

*Unio semiplicatus* Kuster, Con. Cab., p. 279, pl. xciv., fig. 4. Australia.

Simpson (Cat. Naiades, i., 1914, 251) cites this as a synonym of *Medonidus acutissimus* Lea, from Alabama River system, U.S.A.

According to these conclusions, the mussels may be listed thus:—

#### Family PROPEHYRIDELLIDAE.

##### Subfamily VELESUNIONAE.

*Velesunio balonnensis* Conrad. Inland New South Wales.

*Velesunio balonnensis adjunctus* Iredale. Coastal New South Wales.

*Velesunio balonnensis intricatus* Iredale. South Queensland.

*Velesunio danellii* Villa = *jeffreysianus* Lea. Victoria.

*Velesunio shuttleworthi* Kuster = *vittatus* Lea = *moretonicus* Reeve = *legrandi* Petterd. Tasmania.

*Velesunio evansi* A. Adams and Angas. South Australia.

*Westralunio ambiguus* Philippi = *philippianus* Kuster. South-west Australia.

*Westralunio ambiguus carteri* Iredale. West Australia (Perth).

*Alathyria profuga* Gould. Coastal New South Wales.

*Alathyria pertexta* Iredale = *shuttleworthi* Lea. South Queensland.

*Alathyria jacksoni* Iredale. Inland New South Wales.

*Centralhyria stuarti* A. Adams and Angas. South and Central Australia.

*Centralhyria wilsonii* Lea. Mid Queensland.

*Centralhyria wilsonii caurina* Iredale. North-west Australia.

*Centralhyria angasi* Sowerby. Northern Territory.

*Centralhyria angasi subjecta* Iredale. Northern Territory.

*Centralhyria bednallii* Tate. Northern Territory.

*Hyridunio australis* Lamarck. Coastal New South Wales.

*Hyridunio australis orion* Iredale. Victoria.

*Hyridunio australis drapeta* Iredale. South Queensland.

*Hyridunio renutus* Iredale. Gippsland, Victoria.

## Subfamily LORTIELLINAE.

*Lortiella rugata* Sowerby. Northern Territory.  
*Lortiella froggatti* Iredale. North-west Australia.

## Subfamily PROPEHYRIDELLINAE.

*Rugoshyria depressa* Lamarck = *mutabilis* Lea = *paramattensis* Lea. New South Wales.

*Rugoshyria depressa monticola* Iredale. Mt. Kosciusko, N.S.W.

*Rugoshyria depressa sodalis* Iredale. Tasmania.

*Rugoshyria depressa vicinalis* Iredale. Gippsland, Victoria.

*Rugoshyria interserta* Iredale. Mid Queensland.

*Rugoshyria aquilonalis* Iredale. North Queensland.

*Rugoshyria cultelliformis* Conrad. Inland North New South Wales.

*Propehyridella nepeanensis* Conrad = *dorsuosus* Gould = *lessoni* Kuster. Mid New South Wales.

*Propehyridella nepeanensis opportuna* Iredale. North New South Wales.

*Propehyridella nepeanensis narracanensis* Cotton and Gabriel. Victoria.

*Protohyridella glenelgensis* Dennant. Victoria.

## Subfamily CUCUMERUNIONAE.

*Cucumerunio novaehollandiae* Gray = *cucumoides* Lea = *cumingianus* Dunker. North N.S.W., and South Queensland.

Thanks are here tendered to Mr. G. C. Clutton, of the Australian Museum, for the excellent photographs here offered. It must be explained that owing to irregular growth variation no range of dimensions has been given in the text, but a normal medium sized specimen has been selected for figuring, and the measurements of this "norm" are cited in the explanation of the plates here following.

## EXPLANATION OF PLATE III.

- Fig. 1. *Velesunio balonnensis* Conrad, 68 mm. x 48 mm.  
 ,, 2. *Velesunio balonnensis intricatus* Iredale, 73 mm. x 45 mm. Type.  
 ,, 3. *Velesunio balonnensis adjunctus* Iredale, 74 mm. x 45 mm. Type.  
 ,, 4. *Velesunio danellii* Villa, 86 mm. x 51 mm.  
 ,, 5. *Velesunio shuttleworthi* Kuster, 65 mm. x 45 mm.  
 ,, 6. *Velesunio evansi* A. Adams and Angas, 58 mm. x 43 mm.  
 ,, 7. *Velesunio evansi* A. Adams and Angas, 70 mm. x 42 mm.  
 ,, 8. *Westralunio ambiguus* Philippi, 51 mm. x 35 mm.  
 ,, 9. *Alathyria profuga* Gould, 98 mm. x 58 mm.  
 ,, 10. *Alathyria pertexta* Iredale, 115 mm. x 63 mm. Type.  
 ,, 11. *Alathyria jacksoni* Iredale 105 mm. x 62 mm. Type.  
 ,, 12. *Centralhyria stuarti* A. Adams and Angas, 85 mm. x 43 mm.  
 ,, 13. *Centralhyria wilsonii* Lea, 130 mm. x 62 mm.  
 ,, 14. *Centralhyria wilsonii caurina* Iredale, 74 mm. x 39 mm. Type.

## EXPLANATION OF PLATE IV.

- Fig. 1. *Velesunio balonnensis* Conrad, 68 mm. x 48 mm.  
 ,, 2. *Velesunio balonnensis intricatus* Iredale, 73 mm. x 45 mm. Type.  
 ,, 3. *Velesunio balonnensis adjunctus* Iredale, 74 mm. x 45 mm. Type.  
 ,, 4. *Velesunio danellii* Villa, 86 mm. x 51 mm.  
 ,, 5. *Velesunio shuttleworthi* Kuster, 65 mm. x 45 mm.  
 ,, 6. *Velesunio evansi* A. Adams and Angas, 58 mm. x 43 mm.  
 ,, 7. *Velesunio evansi* A. Adams and Angas, 70 mm. x 42 mm.

- „ 8. *Westralunio ambiguus* Philippi, 51 mm. x 35 mm.
- „ 9. *Alathyria profuga* Gould, 98 mm. x 58 mm.
- „ 10. *Alathyria pertexta* Iredale, 115 mm. x 63 mm. Type.
- „ 11. *Alathyria jacksoni* Iredale 105 mm. x 62 mm. Type.
- „ 12. *Centralhyria stuarti* A. Adams and Angas, 85 mm. x 43 mm.
- „ 13. *Centralhyria wilsonii* Lea, 130 mm. x 62 mm.
- „ 14. *Centralhyria wilsonii caurina* Iredale, 74 mm. x 39 mm. Type.

## EXPLANATION OF PLATE V.

- Fig. 1. *Hyridunio australis* Lamarck, 74 mm. x 42 mm.
- „ 2. *Hyridunio australis drapeta* Iredale, 83 mm. x 40 mm. Type.
- „ 3. *Hyridunio renutus* Iredale, 74 mm. x 47 mm. Type.
- „ 4. *Centralhyria angasi* Sowerby, 76 mm. x 45 mm.
- „ 5. *Lortiella froggatti* Iredale, 57 mm. x 26 mm. Type.
- „ 6. *Rugoshyria depressa* Lamarck, 56 mm. x 29 mm.
- „ 7a.b. *Rugoshyria depressa monticola* Iredale, 50 mm. x 30 mm. Type.
- „ 8. *Rugoshyria interserta* Iredale, 73 mm. x 34 mm. Type.
- „ 9. *Rugoshyria aquilonalis* Iredale, 58 mm. x 28 mm. Type.
- „ 10. *Rugoshyria cultelliformis* Conrad, 67 mm. x 31 mm.
- „ 11. *Propehyridella nepeanensis* Conrad, 56 mm. x 33 mm.
- „ 12. *Propehyridella nepeanensis opportuna* Iredale, 68 mm. x 40 mm. Type.
- „ 13. *Propehyridella nepeanensis narracanensis* Cotton and Gabriel, 22 mm. x 14 mm.
- „ 14a.b. *Protohyridella glenelgensis* Dennant, 41 mm. x 23 mm.
- „ 15. *Cucumerunio novaehollandiae* Gray, 127 mm. x 50 mm.

## EXPLANATION OF PLATE VI.

- Fig. 1. *Centralhyria angasi* Sowerby, 76 mm. x 45 mm.
  - „ 2. *Hyridunio australis drapeta* Iredale, 83 mm. x 40 mm. Type.
  - „ 3. *Hyridunio australis* Lamarck, 74 mm. x 42 mm.
  - „ 4. *Hyridunio renutus* Iredale, 74 mm. x 47 mm. Type.
  - „ 5. *Lortiella froggatti* Iredale, 57 mm. x 26 mm. Type.
  - „ 6. *Rugoshyria depressa* Lamarck, 56 mm. x 29 mm.
  - „ 7. *Rugoshyria cultelliformis* Conrad, 67 mm. x 31 mm.
  - „ 8. *Rugoshyria aquilonalis* Iredale, 58 mm. x 28 mm. Type.
  - „ 9. *Rugoshyria interserta* Iredale, 73 mm. x 34 mm. Type.
  - „ 10. *Rugoshyria depressa monticola* Iredale, 50 mm. x 30 mm. Type.
  - „ 11. *Propehyridella nepeanensis* Conrad, 56 mm. x 33 mm.
  - „ 12. *Propehyridella nepeanensis opportuna* Iredale, 68 mm. x 40 mm. Type.
  - „ 13. *Propehyridella nepeanensis narracanensis* Cotton and Gabriel, 22 mm. x 14 mm.
  - „ 14. *Protohyridella glenelgensis* Dennant, 41 mm. x 23 mm.
  - „ 15. *Cucumerunio novaehollandiae* Gray, 127 mm. x 50 mm.
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